

HOW WELLS ARE DESIGNED

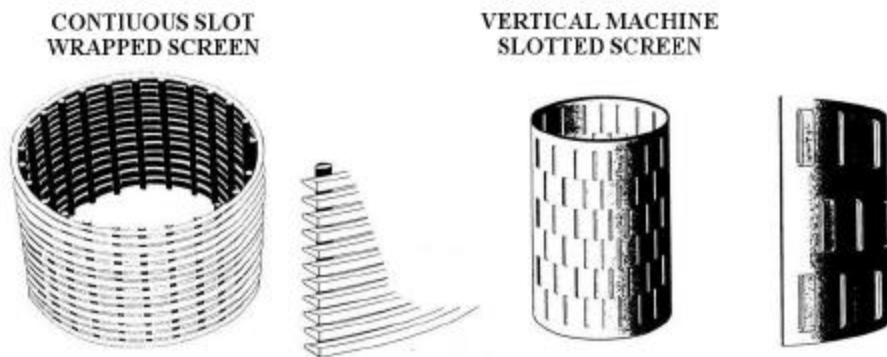
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Many well owners know little or nothing about their wells. All they see is a foot or so of well casing sticking out of the ground. This article looks at just some of the “below ground” aspects of well design that can easily be explained to well owners. Water wells come in all shapes and sizes and need to be designed to suit the geologic conditions, the purpose for needing the water and to comply with local regulations. A water well must be deep enough to reach the saturated rocks or sediments in the aquifer. In low yielding rocks the well may be drilled several hundred feet deeper than the level of ground water in order to provide some water storage in the well column. [One hundred feet depth in a six-inch diameter well below the water table stores 150 gallons of water.]

The well's diameter must be large enough to take the pump equipment necessary to move the water to the surface. Most home wells use four-inch diameter pumps. The well casing lining the drilled hole must extend down far enough to reduce the risk of any surface or near surface contamination. The well may need a screen to allow for the efficient flow of water from the aquifer into the well. In some cases it may be necessary to place additional casing to seal off parts of the drilled hole where, for example, the water may have high iron content, or some other unwanted chemical attribute.

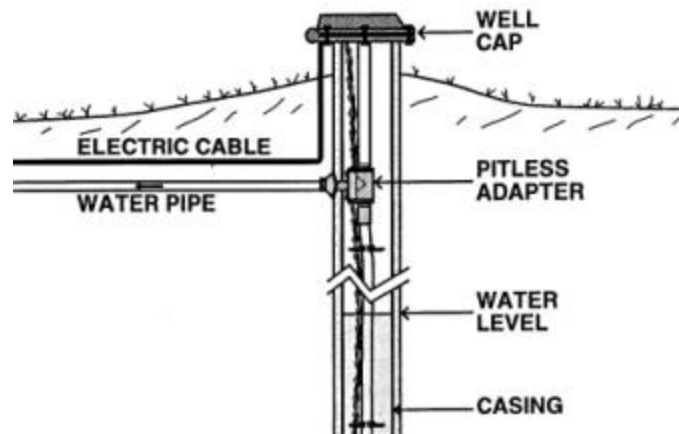
Not only do the above factors form part of well design considerations but there may also be decisions about whether to use steel or plastic casing, about whether to use steel, stainless steel or plastic screens and whether the screens should be wire wrap, slotted or louver. In many states there are regulatory requirements and construction codes that the well contractor has to follow, particularly concerning depth of casing and grout material used to seal the annular space between the hole and the casing. Critical decisions related to well depth, diameter and positioning of screens (if needed) are usually made on a site by site basis depending on the driller's experience in the local area, the drilling equipment selected for constructing the well, and on the specific information on water strikes and rock conditions found during the drilling process.

A well screen is an engineered device that may be used in wells to help maximize inflow from the aquifer and allow for long-term satisfactory operation of the well. Well screens are typically installed in wells where the aquifer is comprised of loose or unstable material. The screen prevents rock fragments from entering the well, helps support the wall of the well and allows water to enter slowly. Turbulent flow can more easily transport unwanted rock particles and agitated water may release minerals and clog up the well. A commonly used screen type for water wells uses a continuous slot construction, made by wrapping and welding a continuous length of wire or plastic around vertical rods. Well Screens are also made by precision machine slotting (vertical or horizontal slots) or by making louver openings. Screens are made in many different slot or opening sizes and are usually installed by fixing the screen to the end of the casing, which is then lowered down the well to the selected water-producing zone(s) of the aquifer.



For high yield wells a “gravel pack” is sometimes used to fill up the space between the well screen and the drilled hole. Placing the gravel in the well next to the screen can be a tricky business, but the highly permeable gravel can really help make the well efficient. Selecting the size of gravel to be used is yet another important well design decision.

For wells where freezing temperatures occur, there has to be a way of diverting water from the well to the home below ground. To achieve this, most contractors will use a special adaptor that connects the vertical pipe coming from the well inside the casing to a horizontal pipe that takes water from the well to the home. This connection is usually made about six feet below ground surface by means of a "pitless adaptor." This device not only connects the well pipe to the house pipe, but also helps support the weight of the pump and pipes. The design of the adaptor fitting with an "O ring" seal, also allows the pump to be removed from the well for servicing or replacement.



All wells should have a secure cap to prevent insects or debris from entering the well. However, the well cap should not have a perfect airtight seal. There must be an air vent so that when the water level drops because of pumping, the space created by the falling water level can be replaced by air. If a well is constructed in an area prone to flooding the casing should be extended up to above the likely flood level.

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